


**HASTINGS**

**INSTRUCTION  
MANUAL**

**MODEL HVC-282  
VACUUM CONTROLLER**

 **ISO 9001**  
KEMA CERT 10192.01

 Accredited by the Dutch  
Council for Accreditation (RvA)

 Accredited by the Registrar  
Accreditation Board (RAB)



**TELEDYNE**  
*Hastings Instruments*  
A Teledyne Technologies Company

# Manual Print History

The print history shown below lists the printing dates of all revisions and addenda created for this manual. The revision level letter increases alphabetically as the manual undergoes subsequent updates. Addenda, which are released between revisions, contain important change information that the user should incorporate immediately into the manual. Addenda are numbered sequentially. When a new revision is created, all addenda associated with the previous revision of the manual are incorporated into the new revision of the manual. Each new revision includes a revised copy of this print history page.

Revision A (Document Number 129-051994) ..... May 1994  
Revision B (Document Number 129-082002) ..... August 2002

## CAUTION

Refer to accompanying documents for electrical connections.  
designed for class II installations.

Hastings Instruments reserves the right to change or modify the design of its equipment without any obligation to provide notification of change or intent to change.

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## 1.0 GENERAL INFORMATION

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This manual contains technical and general information concerning the installation, operation and calibration of the Hastings HVC-282 Vacuum Gauge, and associated components.

For proper operation, the Hastings HVC-282 Vacuum Gauge must be suitably connected to a Hastings Model DV-273 Gauge Tube. Attempting to use this Vacuum Gauge with any other transducer may damage the gauge and or transducer.

### 1.1 Description:

The HVC-282 vacuum instrument offers a digital readout of 0-20 Torr with 0.01 Torr resolution with two adjustable set point relays, using a international input power supply for 115/220VAC 50/60Hz operation depending on internal switch configuration (Please see Sec. 4.0), all in a standard Hastings VT Gauge unit. The DV-273 Hastings gauge tube is rugged but sensitive, specifically made for this range, and matched for interchangeability without recalibration giving extra versatility for all vacuum applications. Tubes are temperature compensated, but do respond to large  $\Delta T$  transients, requiring insulating tubes to reduce temperature transients.

### 1.2 Operating Principle:

Operation of the HVC-282 Vacuum Gauge is based on a low voltage DC bridge which heats a noble metal thermopile. A change in pressure creates a change in the thermal conductivity of gas surrounding the thermopile, thus at vacuum, little power is used to heat the thermopile and at full scale requires maximum power. Power level is indicative of vacuum level present in tube.

### 1.3 Specifications:

Range/ Resolution .....	0-20Torr/0.01 Torr
Readout .....	3 1/2 digit LCD display.
Linear Output .....	0-2VDC $\pm 5\%$ & 3mV with fine span adjustment.
Set Points .....	0- 20 Torr/0.01 Torr, stability of $\pm 3$ counts over $0^{\circ}$ to $50^{\circ}$ Coperational range.
Accuracy .....	$\pm 5\%$ of reading & $\pm 3$ counts. Gauge tube must be protected from large temperature transients. (See 3.2)
Repeatability .....	$\pm 1\%$ of reading & $\pm 3$ counts. Gauge tube must be protected from large temperature transients. (See 3.2)
Power Requirements .....	115VAC $\pm 15V$ or 220VAC $\pm 30V$ (Selectable) 50/60Hz <4 watts.

Hi / Lo Relays ..... SPDT N.O./N.C. up to 125VAC 10A or 277VAC 6A  
 With onetime  $\approx$  10sec. delay to prevent relay chatter,  
 only during unit power up.

Operational Limits ..... 0° to 50°C < 80% RH non-condensating.  
 Storage: -20° to 50°C (Non-operational).

Size ..... Hastings CVT Gauge standard package

Weight Approx. .... 20.2oz./12oz. (0.58Kg/0.33Kg) unit and cables respectively.

Cables ..... 6ft. power cable and 8ft gauge tube cable supplied.  
 Gauge tube cable extensions available.

Gauge Tube Overpressure ..... 150 psi Max. (Absolute pressure)

Gauge Tube Construction ..... Nickel-plated steel with plastic octal base

Stock No. .... HVC-282 (55-282), DV-273 Gauge tube (55-273)

**1.4 Accessories:**

EXTENSION CABLES: Available in 12-ft., 25-ft., 50-ft., and 100-ft. lengths.

STOCK# MODEL# DESCRIPTION

- 65-113 TIN-8-VS 8-foot replacement cable
- 55-84 VP-12-VS 12-foot extension cable
- 55-85 VP-25-VS 25-foot extension cable
- 55-86 VP-50-VS 50-foot extension cable
- 55-87 VP-100-VS 100-foot extension cable

GAUGE TUBE INSTALLATION ACCESSORIES: Quick connects, dropout traps, adapters, and valved quick connects (see Product Bulletin No. 352).

## 2.0 GAUGE TUBE AND CABLES

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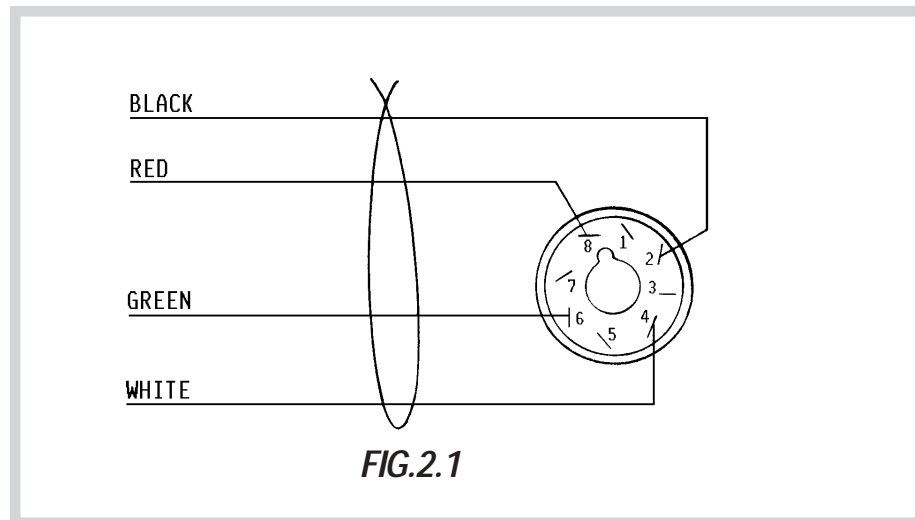
### 2.1 Gauge Tubes:

Octal sockets of standard metal tubes are color-coded for easy identification; DV-273 is dark blue. The tubes are to be installed in 1/8" NPT female thread, or in a Hastings type OS Quick Connector. Maximum overpressure of gauge tube is 150 psi. Construction of shell is of Nickel-plated steel. See section 1.2 for Operating Principle.

### 2.2 Gauge Tube Cables:

The four color-coded wires (Black, Red, White, Green) are connected as shown on the label on the top of can. See Figure 2.1 for socket connections.

Each instrument is shipped with a 6-foot power cable and an 8-foot gauge tube cable. Extension gauge tube cables are available. (See table in Sec-1.5).



## 3.0 INSTALLATION

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### 3.1 Panel Mounting:

Section 8 of this manual shows an outline drawing detailing panel cutout for a standard Hastings CVT Gauge. Install the meter on the panel using the supplied hardware.

### 3.2 Gauge Tube Installation:

Situate the gauge tube in a clean, dry vacuum system with the open end pointing down so as to be self-draining should any vapors condense in it (see Section 6.0). Screw metal tubes into 1/8" female NPT threads using a suitable sealant; Teflon tape is recommended, or use Hastings Quick Connect O-ring seals for a vacuum tight installation. Do not use Quick Connect if tube will see pressures greater than ATM.

For information on Hastings Installation Accessories, refer to Product Bulletin #352.

Gauge tube may be operated immediately, but best results will be obtained after the tube has outgassed for approximately 1 hour.

Tubes are temperature compensated, but do respond to rapid transient environmental changes (greater than 5 degree C/min.) To minimize temperature transients effects please insulate gauge tube with glass wrap or other suitable insulation wrap.



## 4.0 OPERATION

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1) Plug in power cable into any single or two phase AC line for 115VAC or 220VAC 50/60Hz operation, per unit configuration. To change input voltage configuration, remove all connecting wires to rear terminal strips, then removing two small screws at rear, remove can. On lower PC board push slide switch toward rear of can for 115VAC, and toward front of can for 220VAC, reassemble in opposite order. *Remark can as to new voltage configuration.* A 3-wire grounded power cord is supplied with all gauges, if different connector is required, please substitute appropriate 3-wire grounded power cord.

Please allow 30 minutes for tube to adjust to new ambient conditions when moving gauge tube from one environment to another. (See section 3.2)

2) Unit can now be operated with a DV-273 that has been installed as detailed in Section 3.2.

3) Relay set point are adjusted by pressing switch on front display toward HI or LO, and using a small screwdriver to turn trim pot on same side your pressing switch, to adjust and set desired set point. You may configure either N.O. or N.C. by choice of connection on back of terminal block. (See label on top of HVC-282 can.)

4) 0 to 2VDC linear output may be finely adjusted by turning trim pot on left center of can. (Viewed from front display.)

## 5.0 CALIBRATION AND TROUBLESHOOTING GUIDE

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All Hastings Vacuum Gauges and Gauge Tubes have been carefully checked and calibrated at the factory before shipment. If a calibration check is desired, the methods in the following sections may prove helpful.

### 5.1 Checking of Tube:

The simplest and quickest method of checking operation and calibration of a gauge tube is to keep a new spare clean gauge tube on hand as a "standard". To check operation, install both new and old gauge tubes together in the same clean, dry vacuum system, and pump until a steady pressure is obtained. Plug the gauge onto both tubes alternately and check readings. If the old tube reads a higher pressure than the new one, this indicates a shift in the old tube which is most probably the result of tube contamination. Calibration can possibly be restored by gently swishing solvent such as acetone, or ethyl alcohol in the tube end. After cleaning, thoroughly air dry the tube. (Caution: Do not use high pressure air jet, as this will damage the thermopile and damage gauge tube.) If calibration cannot be restored by this procedure, replace the old tube with a new gauge tube. The two tubes can track one another within close tolerance, however, variance of up to 2x of accuracy specification stated for tube may be seen, or check the gauge tube by method described in Section 5.2.

CAUTION: Do not attempt to measure the resistance of the gauge tube element with a DVM while it is under hard vacuum unless it supplies less than 350mV to perform measurement, or more than 929mV at 15 Torr, and never more than 1.5V at ATM between pins 2 (Black) and 8 (Red). A good tube will read around 25-30 ohms. If open or damaged, thermocouples will read much higher.

### 5.2 Calibration

All HVC-282 Vacuum Gauges have been carefully checked and calibrated, along with DV-273 Gauge Tubes which are independently matched for interchangeability. If for some reason you need to calibrate either gauge or gauge tube, please carefully follow calibrating instructions below.

DV-273 calibration. We do not recommend recalibration of the DV-273 gauge tube because of equipment requirements, but we do include a suitable method for your reference. Best possible accuracy will require a Primary Standard and pump system with the ability of pumping down to at least 1 m Torr or better. Please refer to Figure 2.1.

NOTE: For best possible results, temperature changes must be minimized, i.e.; handling must be minimized. (See Sec. 3.2)

Please read Section 3.2.

- a) Apply 350mVDC  $\pm 50\mu\text{V}$  to pins (+)8 & (-)2.
- b) Pump system/gauge tube down to hard vacuum, < 1mTorr.
- c) Using a DVM with a 200mV or better scale, connected to (+)4 & (-)6 and adjust center pot in gauge tube to 0.000mV  $\pm 5\mu\text{V}$ .
- d) Bring system/gauge tube to 15.000  $\pm 1\text{mTorr}$ .
- e) Increase applied 350mV to 929.85mV  $\pm 50\mu\text{V}$ . CAUTION: Possible gauge tube damage will result if at less than 15 Torr.

- f) Adjust outside pot to read  $2.630\text{mV} \pm 5\mu\text{V}$  on DVM.
- g) DV-273 gauge tube is now calibrated.

HVC-282 calibration.

Course adjustment

(Caution: Resistor connections are not to any power terminals.)

- a) With power off, connect an 86.6 ohm 1% 1/8W resistor to tube terminals white & green.
- b) Connect a 28 ohm 1% 1/8W resistor to tube terminals red and black.
- c) Connect a DVM to measure mV across the 28 ohm resistor with (+) lead to red terminal.
- d) With power on, adjust trim pot on right side of can (Viewed from front display.)  
to set  $350\text{mV} \pm 0.5\text{mV}$ .
- e) Set units display to read 0.00 by adjusting zero pot at rear of can.
- f) With power off, attach a  $2.630\text{mV} \pm 5\mu\text{V}$  DC source across (+) white (-) green the 86.6 ohm resistor.
- g) With power on adjust span pot at rear of can till display reads 15.00 Torr.  
Hastings) HVC-282 is now coarsely calibrated.

Fine adjustment.

Due to bridge loading, you will need to readjust zero and span pots using a good or above calibrated DV-273.

- a) Connect and run unit for 30 minutes at hard vacuum ( $< 1\text{mTorr}$ ) so system may out gas.
- b) Readjust zero pot at rear of can if necessary, to set display to read 0.00 Torr.
- c) Using a Primary standard, bring system up to  $15.000\text{ Torr} \pm 1\text{mTorr}$ .
- d) Readjust span pot at rear of can if necessary, to set display to read 15.00 Torr.
- e) Fine Calibration is now complete.

### **5.3 Check Against Primary Standard:**

If additional calibrations of the vacuum gauge are desired, an accurate measuring device such as the McLeod Gauge, spinning rotor gauge, or capacitance manometer may be employed as a reference. Please refer to manufacture for the suitability requirements. Please read Sec. 6.

## 6.0 NOTES ON VACUUM MEASUREMENT

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### 6.1 *Effects of Condensable Vapors:*

If the readings of Hastings Vacuum Gauges are to be compared with readings of other types of gauges, consideration must be given to the possible effects of condensable vapors in the system on the other gauges. For example, none of the many types of the McLeod Gauge give correct readings if condensable vapors such as water, alcohol, acetone, etc., are present in the system/gauge. The McLeod Gauge operates by compressing residual gases and vapors to obtain a reading, thus this compression will tend to condense any vapors that are present. This usually results in the McLeod Gauge reading a lower pressure than actual. Unlike the McLeod Gauge, the Hastings Thermopile Vacuum Gauges have the very useful property of responding to the total pressure of all gases and vapors that are present in the system/gauge tube.

To exclude vapors from the McLeod Gauge it is necessary to employ a trap of some kind that will absorb or condense the vapors. Water vapor is by far the most common source of difficulty. A trap cooled by liquid nitrogen is effective in removing vapors, also system must be given time to outgas. Reference should be made to the instructions furnished by the manufacture to the suitability needs of Gauge used.

### 6.2 *Outgassing:*

Hastings Gauge Tubes are made of materials that have been proven by years of usage to be relatively free from outgassing. However, all surfaces of glass and metal that are exposed to the vacuum system may liberate gases and vapors that were previously absorbed during exposure to the atmosphere. If the surfaces are contaminated with foreign matter, this outgassing may be much more persistent than if the surfaces are clean. The possibility of outgassing must be considered in checking the accuracy of Hastings Gauges or in checking for leaks. This is especially important when working with pressure of less than 10 microns of mercury (or .01 millibars). In this range of pressure, outgassing from surfaces in a newly evacuated system may flood the enclosure. Also, if the system is being pumped continuously, gauges spaced at different distances from the pump will register different pressures. For reliable comparison of different Vacuum Gauge, it is necessary then to insure that the vacuum system be free of any outgassing or other possible leaks, and that they be taped to the system near the same point. This can best be determined by closing the system off from the pumps and observing if there is any rise in pressure within the range of interest.

### 6.3 *Effect of Thermal Conductivity:*

All Hastings Vacuum Gauges are originally calibrated in dry air. Since this calibration is a function of thermal conductivity, any gas having a thermal conductivity different from that of air will also have a different calibration.

### 6.4 *Effect of System Conductance:*

Each element that makes up a vacuum system has associated with it a certain conductance (this is the opposite of resistance). For example, baffles, connecting tubing, and sharp turns can all cause pressure drops throughout the system during pumping and during the time the system is reaching static equilibrium. It is not an uncommon occurrence to measure different pressures at different locations in a vacuum system. In checking the calibration of any vacuum gauge, care must be taken to insure that the gauge and the reference are at the same pressure.

## 7.0 SERVICE INFORMATION

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### 7.1 Warranty Repair Policy

Hastings Instruments warrants this product for a period of one year from the date of shipment to be free from defects in material and workmanship. This warranty does not apply to defects or failures resulting from unauthorized modification, misuse or mishandling of the product. This warranty does not apply to batteries or other expendable parts, nor to damage caused by leaking batteries or any similar occurrence. This warranty does not apply to any instrument which has had a tamper seal removed or broken.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty as to fitness for a particular use. Hastings Instruments shall not be liable for any indirect or consequential damages.

Hastings Instruments, will, at its option, repair, replace or refund the selling price of the product if Hastings Instruments determines, in good faith, that it is defective in materials or workmanship during the warranty period. Defective instruments should be returned to Hastings Instruments, **shipment prepaid**, together with a written statement of the problem and a Return Material Authorization (RMA) number. Please consult the factory for your RMA number before returning any product for repair. Collect freight will not be accepted.

### 7.2 Non-Warranty Repair Policy

Any product returned for a non-warranty repair must be accompanied by a purchase order, RMA form and a written description of the problem with the instrument. If the repair cost is higher, you will be contacted for authorization before we proceed with any repairs. If you then choose not to have the product repaired, a minimum will be charged to cover the processing and inspection. Please consult the factory for your RMA number before returning any product repair.

TELEDYNE HASTINGS INSTRUMENTS

804 NEWCOMBE AVENUE

HAMPTON, VIRGINIA 23669 U.S.A.

ATTENTION: REPAIR DEPARTMENT

TELEPHONE (757) 723-6531

1-800-950-2468

FAX (757) 723-3925

E MAIL [hastings\\_instruments@teledyne.com](mailto:hastings_instruments@teledyne.com)

INTERNET ADDRESS <http://www.hastings-inst.com>

Repair Forms may be obtained from the "Information Request" section of the Hastings Instruments web site.



**7.3 Service Form:**

Teledyne Hastings Instruments  
804 Newcombe Avenue  
Hampton, VA 23669 U.S.A.  
Telephone (757)723-6531 Fax (757)723-3925

RMA# \_\_\_\_\_  
(contact factory)

Model No. \_\_\_\_\_ Serial No. \_\_\_\_\_ P.O. No. \_\_\_\_\_ Date \_\_\_\_\_  
Name \_\_\_\_\_ Phone \_\_\_\_\_  
Company \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
Describe problem: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Show a block diagram of your system including unit inlet and outlet pressures:

Calibration range \_\_\_\_\_ Gas \_\_\_\_\_ Cable length \_\_\_\_\_  
Power line voltage \_\_\_\_\_ Variation \_\_\_\_\_  
Ambient temperature \_\_\_\_\_ Gas Temperature \_\_\_\_\_  
Other \_\_\_\_\_  
(If special modifications have been made by user, please describe): \_\_\_\_\_  
\_\_\_\_\_

Application of product being returned \_\_\_\_\_  
\_\_\_\_\_

Has this product been used with a hazardous material? YES NO

If YES, please list types of gas, chemicals (common names, specific chemical), biological materials, or other potentially harmful materials exposed to the product during its use (attach additional page if necessary) \_\_\_\_\_  
\_\_\_\_\_

**PRODUCTS EXPOSED TO RADIOACTIVE MATERIAL CANNOT BE ACCEPTED BY HASTINGS INSTRUMENTS UNDER ANY CIRCUMSTANCES.**

Signature of Hazards Control Officer: \_\_\_\_\_

For questions regarding use of the product and materials in contact with it:

Name \_\_\_\_\_ Phone \_\_\_\_\_





## 8.0 DRAWINGS and DIAGRAMS

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This section contains the schematics, parts list, and overall assembly drawings. If replacement parts are desired, they can be obtained from the factory by referencing the Hastings part number listed on the parts lists.

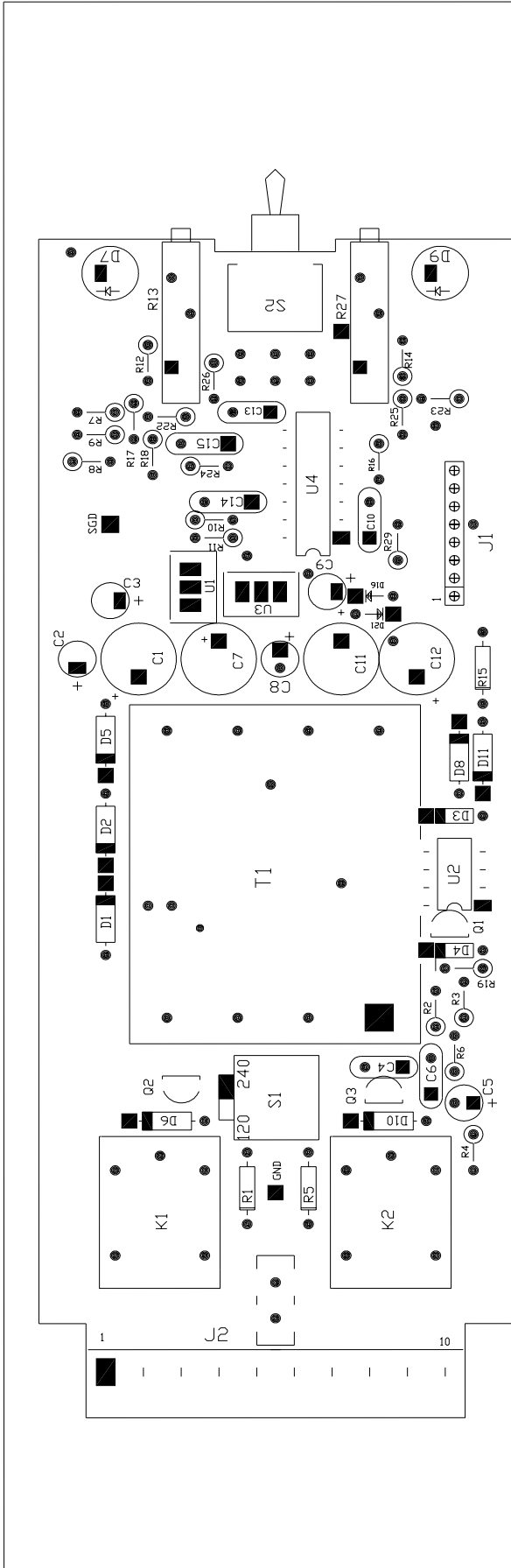
REVISONS			
REV	DESCRIPTION	DATE	APPROVED
A	INITIAL ISSUE		

24	2	19-05-016	POT 5K OHM BRNS 300 fp	R13,27
23	2	18-01-369	RES 453 OHM 1/4 W 1% RN55D METAL	R11,25
22	2	18-01-360	RES 453K OHM 1/4 W 1% RN55D METAL	R7,17
21	2	18-01-349	RES 100 OHM 1/8 W 1%	R1,5
20	1	18-01-342	RES 402K OHM 1/8 W 1%	R4
19	2	18-01-341	RES 100K OHM 1/8 W 1%	R6,15
18	1	18-01-304	RES 200K OHM 1/8 W	R3
17	1	18-01-297	RES 90.9K OHM 1/8 W	R16
16	1	18-01-275	RES 1 MEG OHM 1/8 W 1%	R19
15	1	18-01-272	RES 10K OHM 1/8 W 1%	R29
14	6	18-01-271	RES 49.9K OHM 1/8 W 1%	R9,10,12,22,24,26
13	4	18-01-270	RES 1000 OHM 1/8 W 1%	R8,14,18,23
12	1	16-20-064	SUBMINI TERM BLK 2MR-10	J2-1 THRU J2-10
11	1	16-20-063	BOX CONN STRIP #BCS-108L-S-P-E	J1-1 THRU J1-8
10	2	13-01-164	LED W/HOLDER DIALIGHT 550-2406	D7,9
9	1	13-01-163	DIODE 1N4689 5.1V ZENER	D1
8	4	13-01-110	DIODE 1N914	D3,4,16,21
7	1	12-01-134	TRANSF #LP-20-300 115/230 PRI	T1
6	4	11-09-062	CAP .1 MFD 50V 5% STACK METAL	C4,6,10,13
5	2	11-03-171	CAP 2.2 MFD 50V TANT	C2,8
4	2	11-03-165	CAP 2.2 MFD 25V TANT	C3,9
3	4	11-03-151	CAP 470 MFD 25V ELECTRO	C1,7,11,12
2	1	11-03-118A	CAP 22 MFD 16V TANT	C5
1	2	11-01-168	CAP .01 MFD 25V CER	C14,15

ITEM NO.	QTY	FSCM RECD	IND.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	REF /DWG NO.
PARTS LIST						
UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES FRACTIONS ARE DECIMALS ANGLES ARE DEGREES		ITEM MASTER NO.		TELEDYNE Hastings Instruments		
1/64 .xxx+.005		65-651		ASSEMBLY DIAGRAM		
MATERIAL		DRAWN		PC-823 POWER SPLY BRD HVC-282		
SEE PARTS LIST		JEFFREY SLAY		SIZE FSCM NO. DWG NO. 30973		
FINISH		CHECKED		REV A		
NEXT ASSY		ISSUED		SCALE NONE SHEET 1 OF 3		
USED ON		DRAWN		DO NOT SCALE DRAWING		
APPLICATION		CHECKED				
		ISSUED				

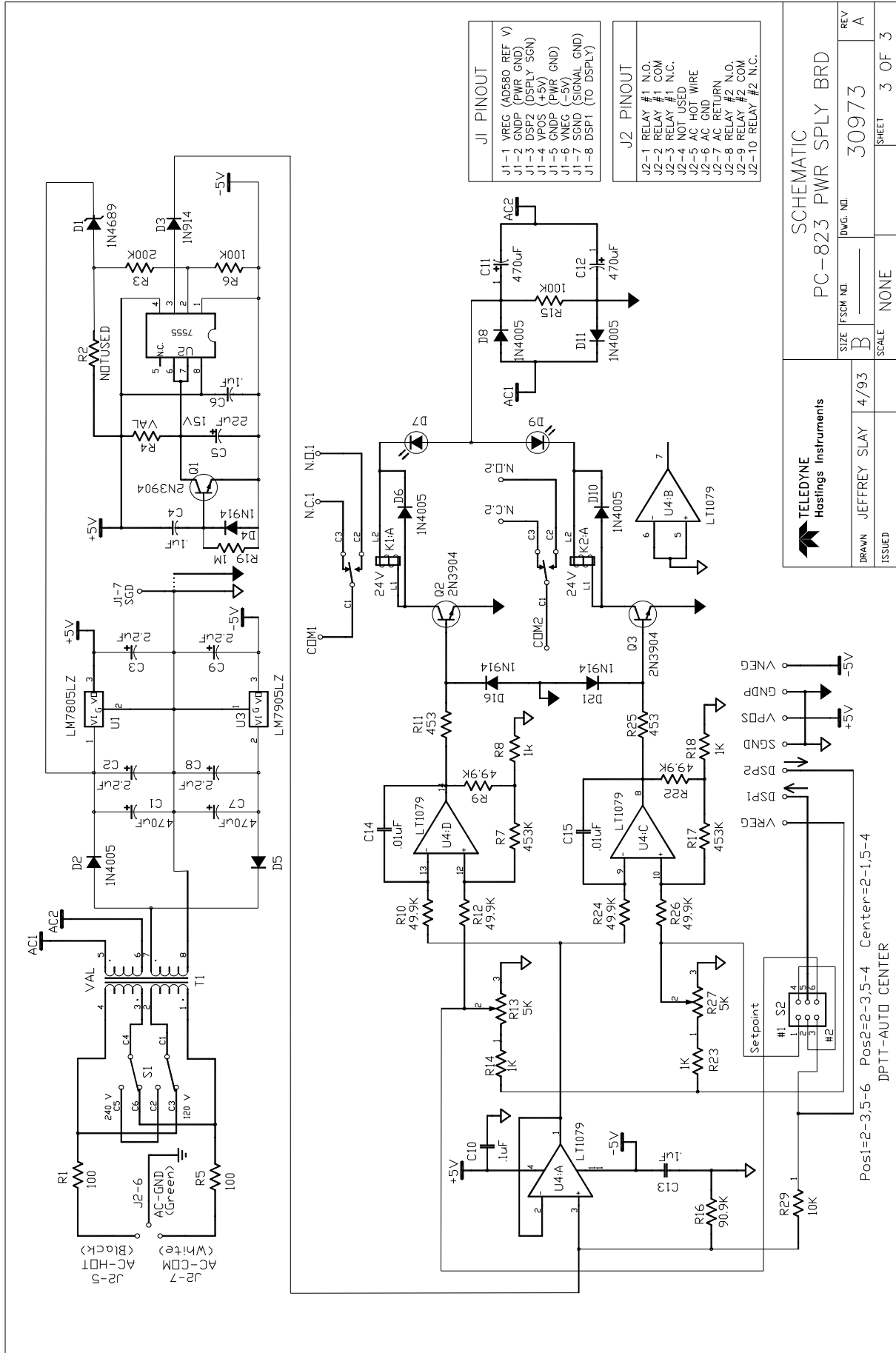


ITEM NO.	QTY	FSCM RECD NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	REF/DWG NO.
35	1		56-02-087	IC LT1079CN QUAD OPR AMP	U4
34	1		56-02-062	IC ICM-7555 IPA TIMMER ICL	U2
33	1		56-02-047	IC MC7905CT -5V REG	U3
32	1		56-02-020	IC UA7805	U1
31	3		51-06-006	TRANSISTOR 2N3904 MOT HI FREQ	Q1,2,3
30	6		36-01-031	DIODE #S-16 1N2071 1A 600V	D2,5,6,8,10,11
29	1		28-10-106	TEST PT 2A TP103-03 COMP CORP	SGD
28	2		28-09-131	RELAY AROMAT JS1E-24	K1,2
27	1		26-04-823	BARE BOARD PC-823	
26	1		20-03-051	SW DPDT RT ANGLE SLIDE PC MTG	S1
25	1		20-02-046	SWITCH C&K #7215SP-D9-A-G-E	S2

PARTS LIST			
TELEDYNE BROWN ENGINEERING Hastings Instruments		ASSEMBLY DIAGRAM	
DRAWN JEFFREY SLAY 4/93		PC-823 POWER SPLY BRD	
ISSUED	SCALE NONE	SIZE FSCM NO. B	DWG. NO. 30973
		REV A	REV A
		SHEET 2	OF 3

**NOTES**

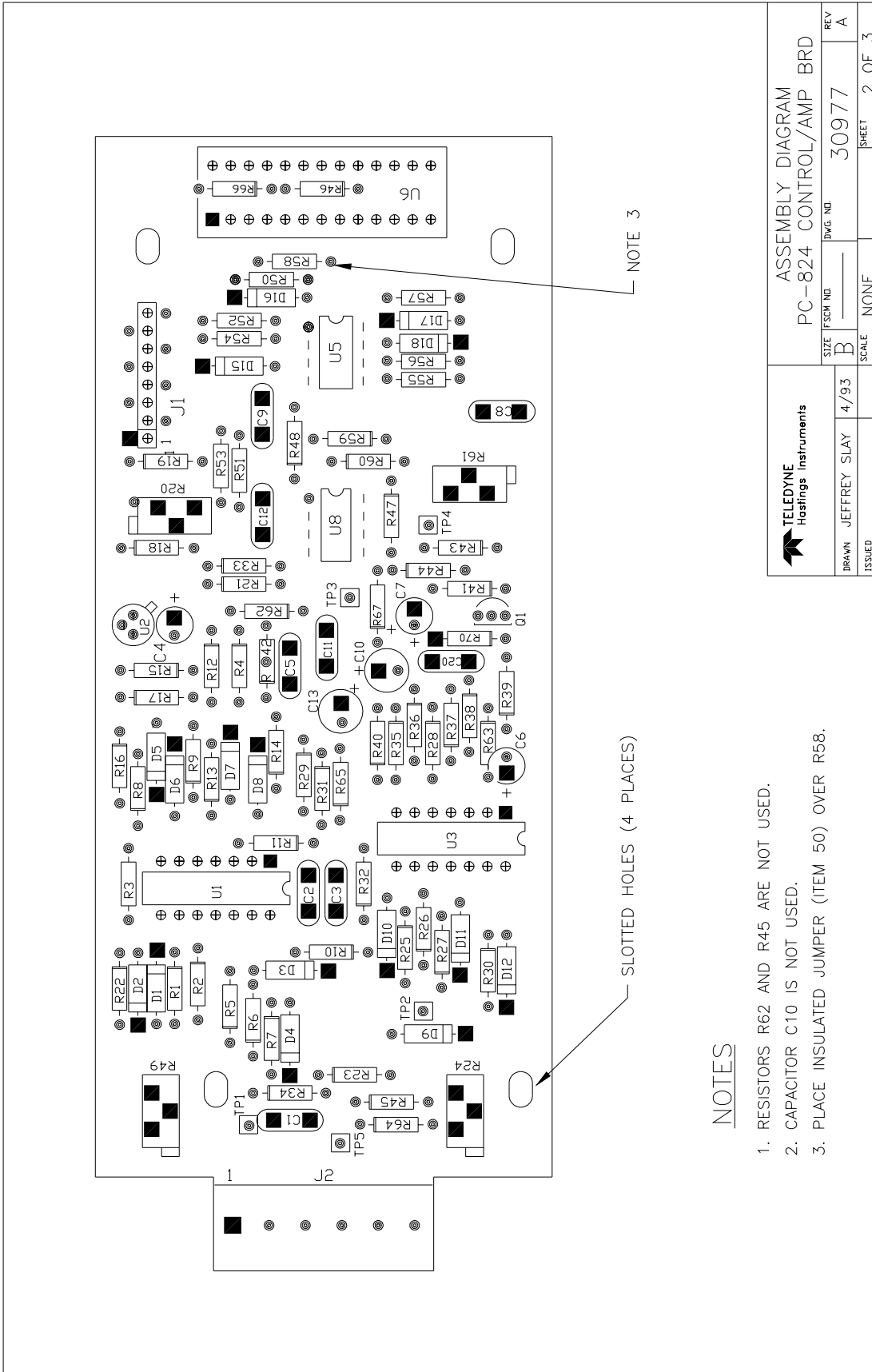
1. RESISTOR R2 IS NOT USED.
2. THE FOLLOWING RESISTORS ARE MOUNTED VERTICALLY:  
R3 R8 R12 R18 R25  
R4 R9 R14 R22 R26  
R6 R10 R16 R23 R29  
R7 R11 R17 R24
3. THE FOLLOWING DIODES ARE MOUNTED VERTICALLY:  
D16  
D21
4. COMPONENT J1 IS LOCATED ON SOLDER SIDE OF BOARD.
5. INSTALL COMPONENT S1 LAST, AFTER DIPPING BOARD.



REVISIONS		
REV	DESCRIPTION	DATE
A	INITIAL ISSUE	

ITEM NO.	QTY	FSCM NO.	RECD	DESCRIPTION	ITEM MASTER NO.	DATE	APPROVALS	DRAWN	CHECKED	ISSUED	SIZE	FSCM NO.	DWG NO.	SCALE	SHEET
24	1			RES 562 OHM 1/4W 1% RN55D MTL	18-01-368										1 OF 3
23	3			RES 4.75K OHM 1/4W 1% METAL FILM	18-01-364										
22	2			RES 243 OHM 1/4W 1% METAL FILM	18-01-363										
21	2			RES 4.02K OHM 1/8W 1%	18-01-353										
20	1			RES 100 OHM 1/8W 1%	18-01-349										
19	3			RES 100K OHM 1/8W 1%	18-01-341										
18	1			RES 30.1K OHM 1/8W	18-01-317										
17	3			RES 499 OHM 1/8W	18-01-306										
16	4			RES 10K OHM 1/8W 1%	18-01-272										
15	16			RES 49.9K OHM 1/8W 1%	18-01-271										
14	1			RES 38.3K OHM 1/4W 1% AX LD	18-01-261										
13	1			RES 35.7K OHM 1/4W 1% AX LD	18-01-259										
12	1			RES 34.8K OHM 1/4W 1% AX LD	18-01-258										
11	1			RES 21K OHM 1/4W 1% AX LD	18-01-250										
10	2			RES 6980 OHM 1/4W 1% AXIAL LEADS	18-01-238										
9	1			RES 1K OHM 1/4W 1%	18-01-221										
8	1			SUBMINI TERM BLK 2MR-06	16-20-065										
7	1			BOX CONN STRIP # BCS-108L-S-P-E	16-20-063										
6	1			DIODE VOLT REG # AD580JH	13-01-147										
5	16			DIODE 1N914	13-01-110										
4	8			CAP .1 MFD 50V 5% STACK METAL	11-09-062										
3	2			CAP 10 MFD 15V TANT	11-03-150										
2	2			CAP 22 MFD 16V TANT	11-03-118A										
1	1			CAP 1000 MMF CER DISC DD-102G	11-01-043										
ITEM NO.	QTY	FSCM NO.	RECD	DESCRIPTION	PART OR IDENTIFYING NO.	DATE	APPROVALS	DRAWN	CHECKED	ISSUED	SIZE	FSCM NO.	DWG NO.	SCALE	SHEET

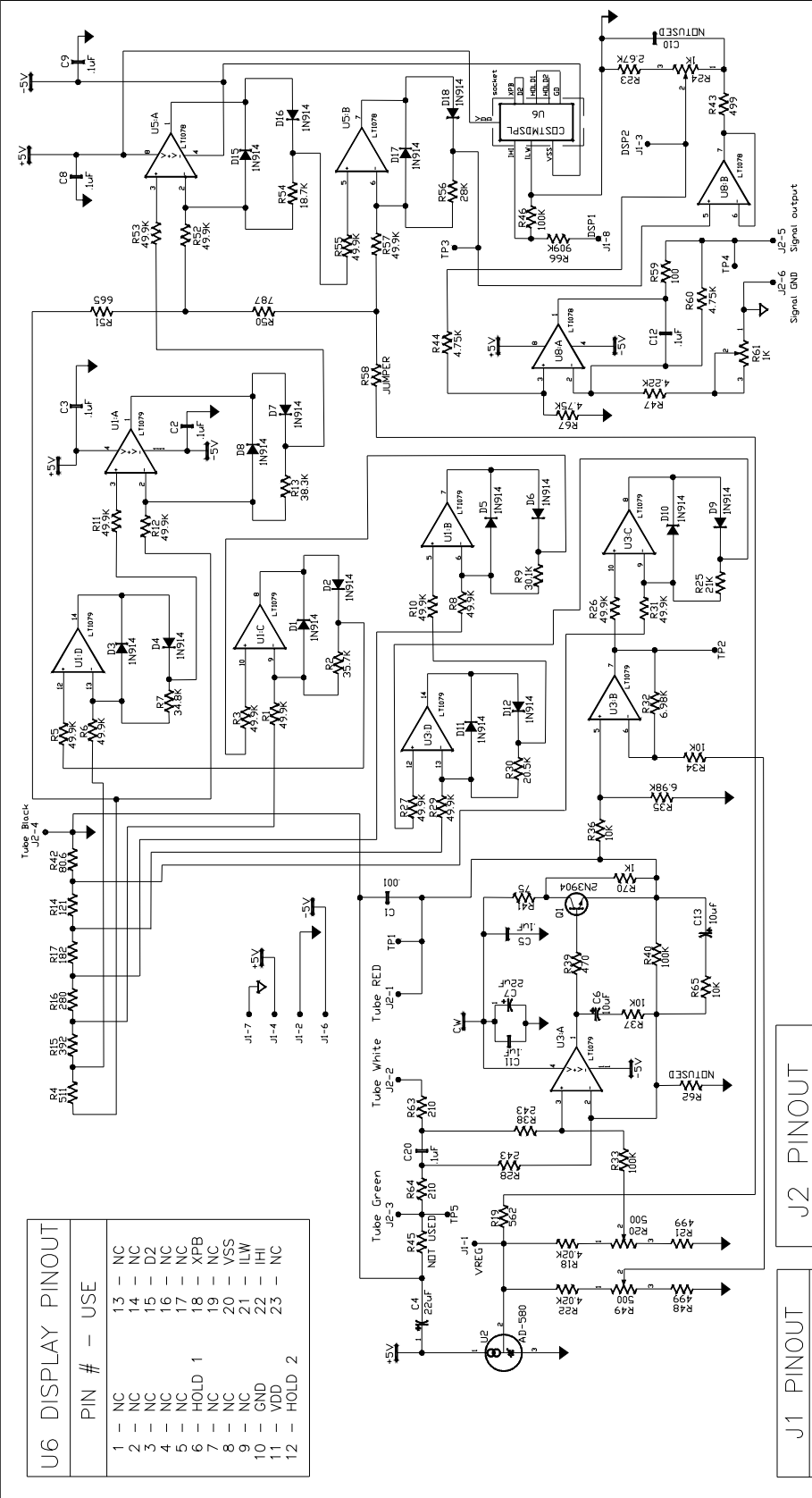
ITEM NO.	QTY	FSCM NO.	RECD	DESCRIPTION	ITEM MASTER NO.	DATE	APPROVALS	DRAWN	CHECKED	ISSUED	SIZE	FSCM NO.	DWG NO.	SCALE	SHEET
50	1			JUMPER SHORT (SEE NOTE 3 SHEET 2)											
49	2			IC LT1078ACN8 DUAL											
48	2			IC LT1079CN QUAD OPR AMP											
47	1			TRANSISTOR 2N3904 MOT HI FREQ											
46	5			TEST PT 2A TP103-03 COMP CORP											
45	1			SOCKET # P299-93-626-10-002											
44	1			PC-824 BARE BOARD											
43	2			POT 500 OHM BRNS 3296Z-1-501											
42	2			POT 1K OHM 3/8 SQ SIDE BRNS 3296Z											
41	1			RES CARB 470 OHM 1/4W 5%											
40	1			RES CARB 75 OHM 1/4W 5%											
39	2			RES 210 OHM 1/4W 1%											
38	1			RES 909K OHM 1/8W 1% AX LD MF											
37	1			RES 20.5K OHM 1/4W 1% METAL											
36	1			RES 18.7K OHM 1/4W 1% METAL											
35	1			RES 787 OHM 1/4W 1% METAL											
34	1			RES 665 OHM 1/4W 1% METAL											
33	1			RES 511 OHM 1/4W 1% METAL											
32	1			RES 392 OHM 1/4W 1% METAL											
31	1			RES 280 OHM 1/4W 1% METAL											
30	1			RES 182 OHM 1/4W 1% METAL											
29	1			RES 121 OHM 1/4W 1% METAL											
28	1			RES 80.6 OHM 1/4W 1% METAL											
27	1			RES 28K OHM 1/4W 1% METAL FILM											
26	1			RES 4.22K OHM 1/4W 1% METAL FILM											
25	1			RES 2.67K OHM 1/8W 1% MTL											
ITEM NO.	QTY	FSCM NO.	RECD	DESCRIPTION	PART OR IDENTIFYING NO.	DATE	APPROVALS	DRAWN	CHECKED	ISSUED	SIZE	FSCM NO.	DWG NO.	SCALE	SHEET



NOTES

1. RESISTORS R62 AND R45 ARE NOT USED.
2. CAPACITOR C10 IS NOT USED.
3. PLACE INSULATED JUMPER (ITEM 50) OVER R58.

		ASSEMBLY DIAGRAM	
		PC-824 CONTROL/AMP BRD	
SIZE	FSCR NO.	DWG. NO.	REV.
B		30977	A
DRAWN		SCALE	SHEET
JEFFREY SLAY		NONE	2 OF 3
ISSUED			



U6 DISPLAY PINOUT	
PIN #	USE
1	NC
2	NC
3	NC
4	NC
5	NC
6	NC
7	HOLD 1
8	NC
9	NC
10	GND
11	VDD
12	HOLD 2
13	NC
14	NC
15	D2
16	NC
17	NC
18	XPB
19	NC
20	VSS
21	ILW
22	IHI
23	NC

J2 PINOUT	
J2 - 1	RED TUBE WIRE
J2 - 2	WHITE TUBE WIRE
J2 - 3	GREEN TUBE WIRE
J2 - 4	BLACK TUBE WIRE
J2 - 5	SIGNAL OUTPUT
J2 - 6	SIGNAL GND

J1 PINOUT	
J1 - 1	VREG (AD580 REF V)
J1 - 2	GNDP (POWER GND)
J1 - 3	DSP2 (DISPLAY SGN)
J1 - 4	VPOS (+5V)
J1 - 5	GNDP (POWER GND)
J1 - 6	VNEG (-5V)
J1 - 7	SGND (SIGNAL GND)
J1 - 8	DSP1 (TO DSPLY)

TELEDYNE  
Hastings Instruments

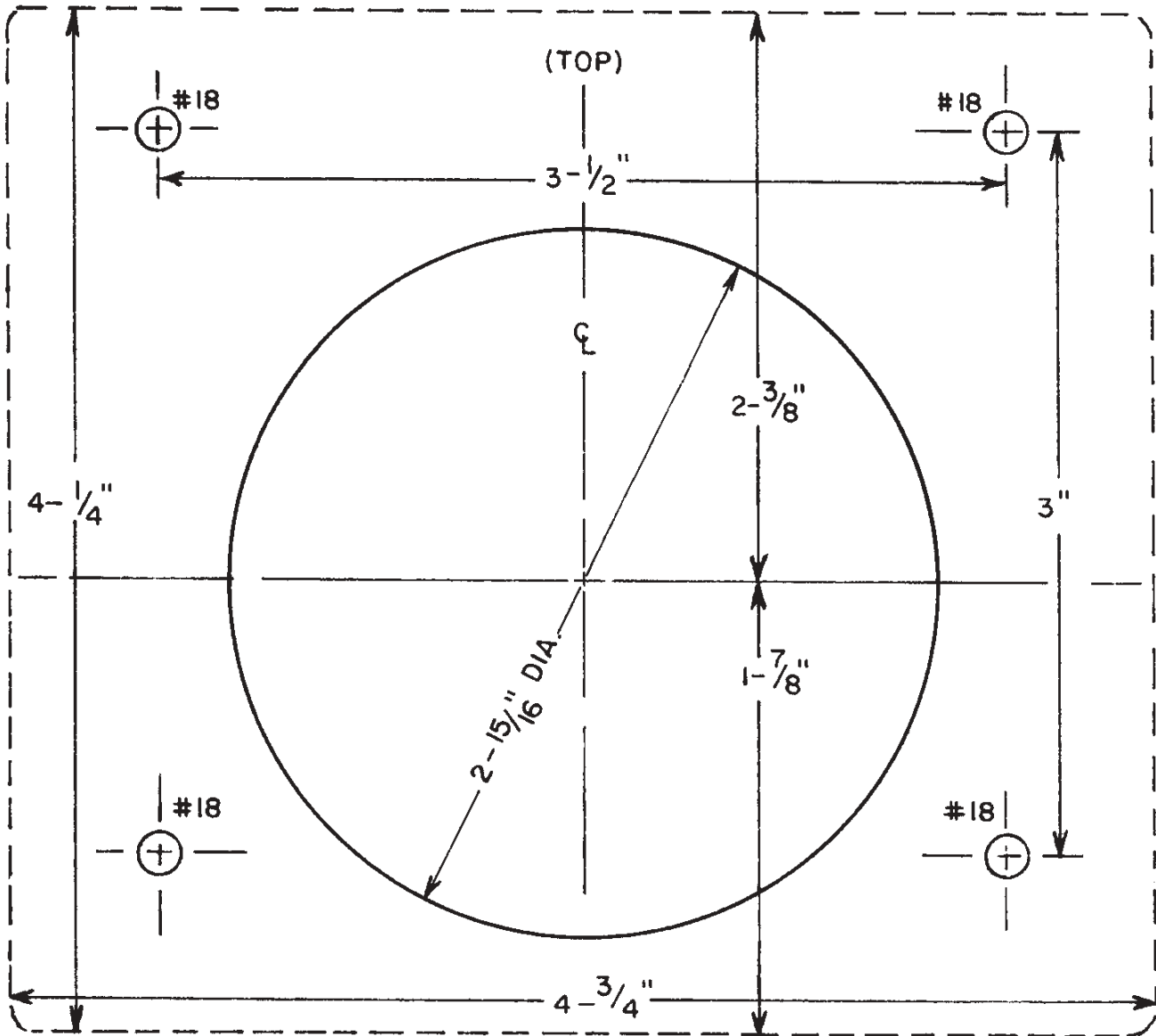
PC-824 CONTROL/AMP BRD

SIZE B FSKD NO. 30977

DRAWN JEFFREY SLAY 4/93

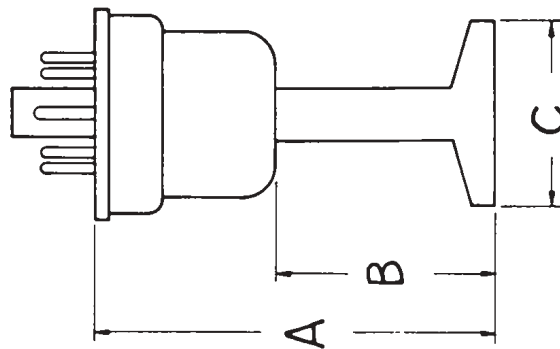
ISSUED NONE SCALE NONE SHEET 3 OF 3

USE FOR MOUNTING ONE SINGLE-POSITION, COMPACT VACUUM GAUGE

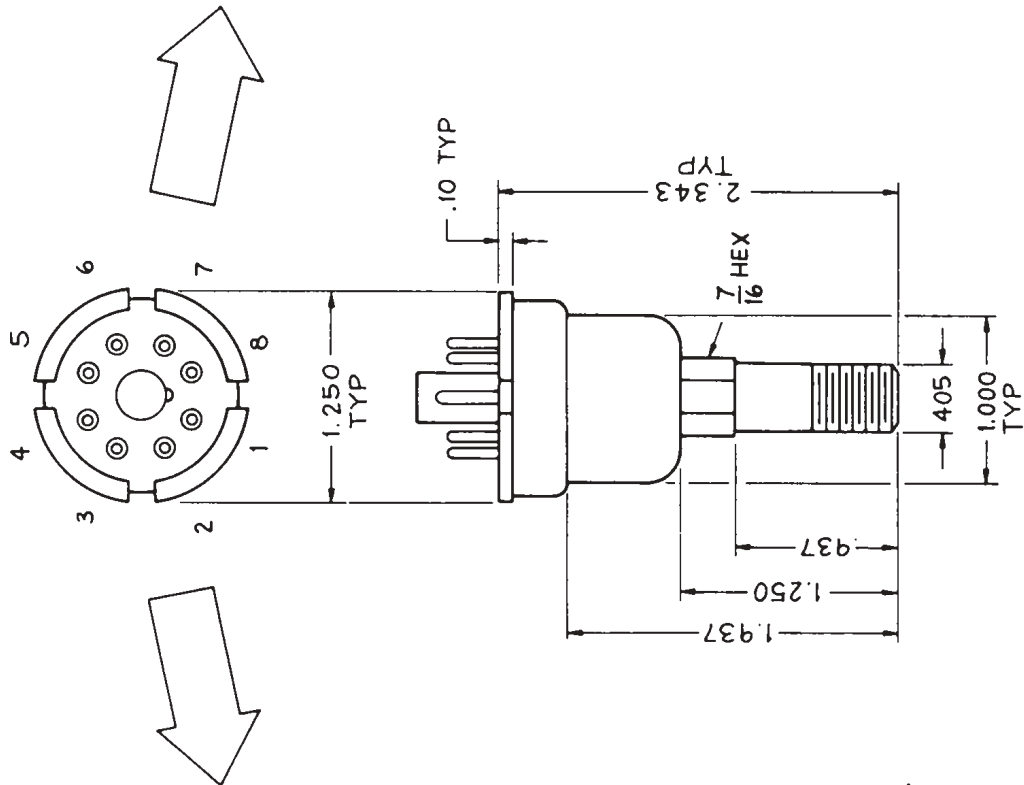




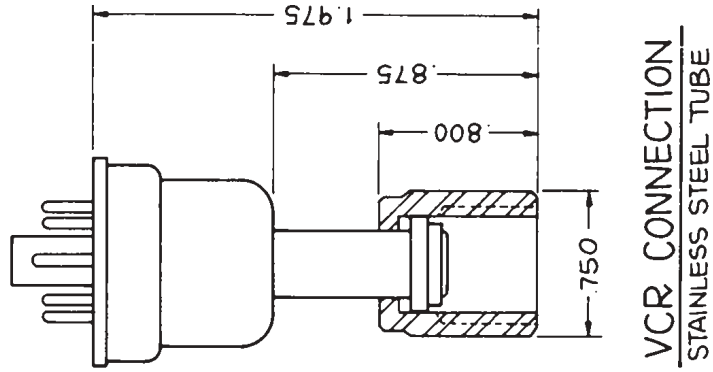
DIMENSION TABLE FOR KF-16/25			
MODEL TYPE	DIMENSIONS		
	A	B	C
KF-16	2.05	1.08	1.180
KF-25	2.15	1.15	1.57



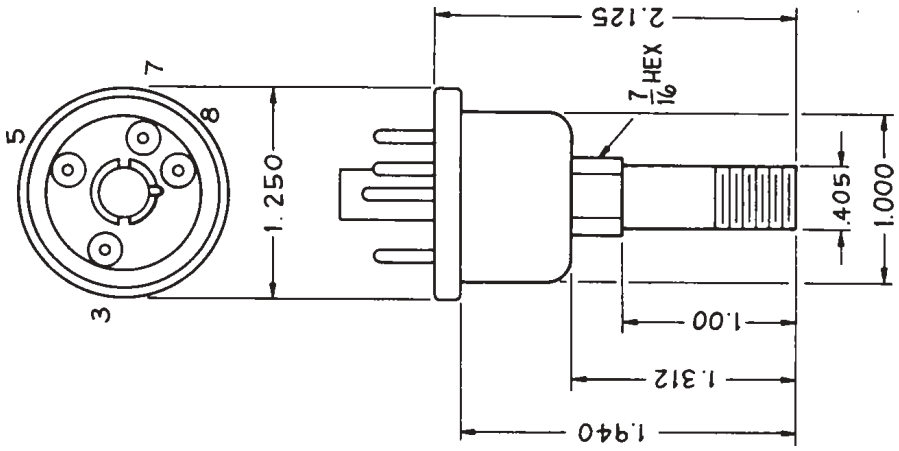
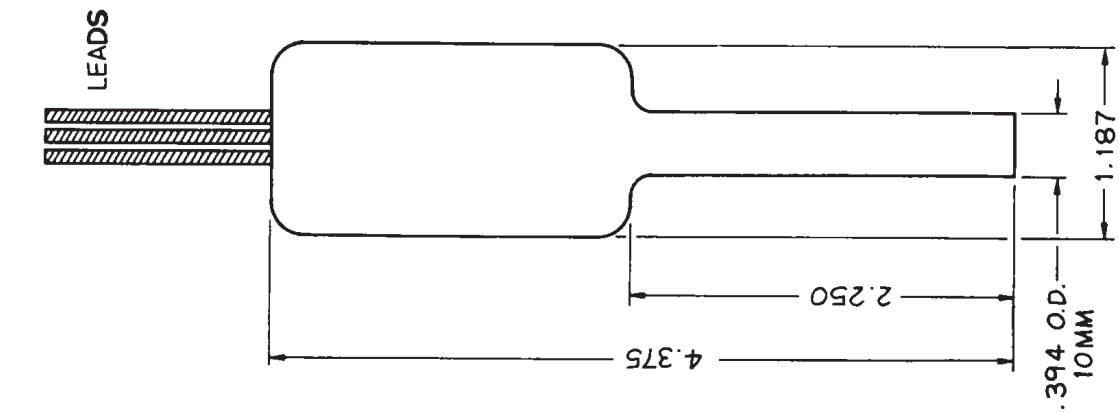
**KF-16/25 CONNECTION**  
STAINLESS STEEL TUBE



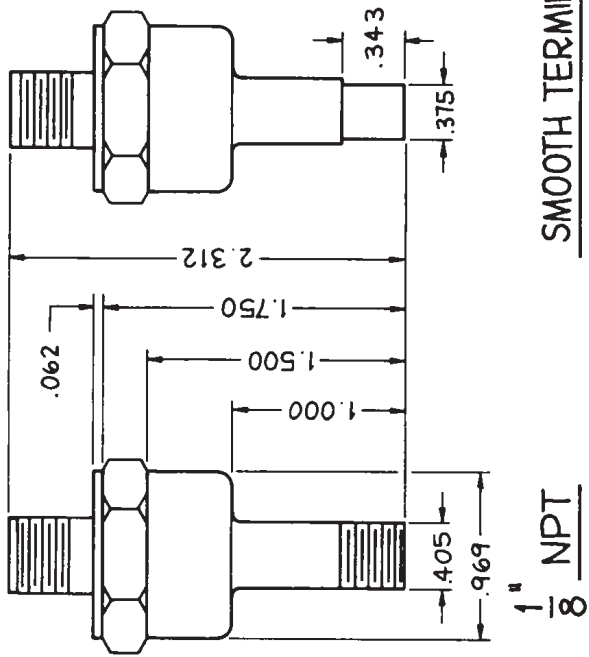
**1/8 NPT CONNECTION**  
NICKEL PLATED STEEL TUBE



**VCR CONNECTION**  
STAINLESS STEEL TUBE



R' SERIES TUBE



SMOOTH TERMINATION

STAINLESS / CERAMIC TUBE